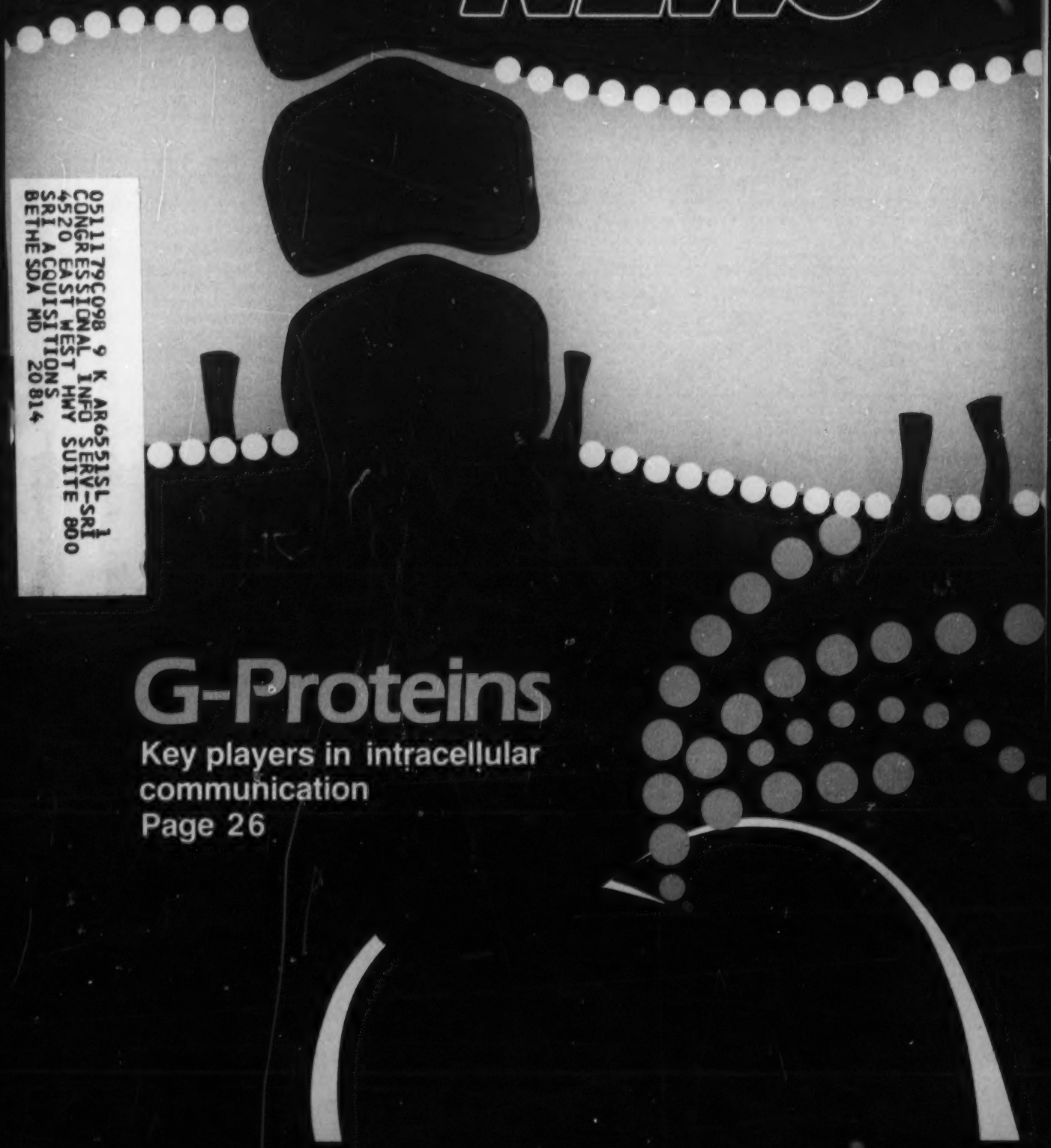
A1250-1
12/21/87

DECEMBER 21, 1987

CHEMICAL & ENGINEERING

NEWS

05111 79C098 9 K AR651SL 1
CONGRESSIONAL INFO SERV-SRI
4520 EAST WEST HWY SUITE 800
SRI ACQUISITIONS
BETHESDA MD 20814



G-Proteins

Key players in intracellular communication

Page 26

CHEMICAL & ENGINEERING
NEWS

Volume 65, Number 51
CENEAR 65 (51) 1–72
ISSN 0009-2347

DECEMBER 21, 1987

News of the Week

■ **Final text of U.S.-Canada free trade agreement issued by U.S. Trade Representative faces scrutiny of chemical industry and Congress.** **Page 4**

■ **Problem of lead contamination of drinking water is being investigated by EPA.** **Page 5**

■ **Hires of new college graduates by large U.S. firms will increase about 10% in 1988, reflecting firms' confidence in continued economic growth.** **Page 5**

■ **In Bhopal case, Union Carbide is ordered to pay $270 million as interim sum for the relief of victims of the December 1984 disaster.** **Page 6**

■ **NMR screening test to detect cancer is stirring growing controversy among scientists who say they have not been able to confirm its validity.** **Page 6**

Business

Capital expenditures by U.S. industry are slated to increase 20% in 1988, as rising exports keep capacity use high. **Page 9**

Government

Clean Air Act amendments approved by Senate set stricter limits on toxic air pollutants, stricter controls on acid rain precursors. **Page 13**

Tighter controls on handling and disposal of polychlorinated biphenyls would be set by House bill. **Page 14**

Technology

Chem Show, held recently in New York City, showcased the state of the art in commercial process equipment and instrumentation. **Page 16**

Automated DNA amplification system reduces time needed to make microgram quantities of genetic material. **Page 24**

NASA is considering converting space shuttle external fuel tank into housing for an orbiting telescope. **Page 24**

Proposed guidelines for AIDS clinical lab workers are issued by the National Committee for Clinical Laboratory Standards. **Page 25**

Meetings

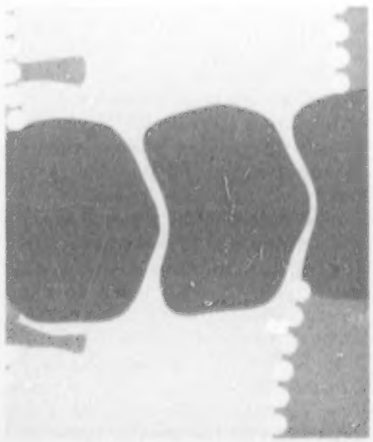
Deadlines and topics for ACS meetings in fall 1988, spring 1989, and later dates are included; C&EN's semiannual calendar of meetings and events lists those of interest to chemists, chemical engineers. **Page 46**

Cover: Artist's conception of inositol phosphate communication pathway, one of several involving G-proteins. Design courtesy of National Institutes of Health

Letters 2

Concentrates
Business 7
Government 12
Science/Technology 15

The Departments
ACS News 40
New Products 42
Awards 45
Newscripts 72



Special Report

G-Proteins—guanine-nucleotide-binding-proteins—that couple receptors to enzymes to elicit a response within the cell are prominent area of research in cellular communication and are linked to several major diseases. **Page 26**

Chemical & Engineering News

1155—16th St., N.W., Washington, D.C. 20036

Editor: Michael Heylin
Assistant Managing Editors: David M. Kiefer, James H. Krieger, Janice R. Long, Donald J. Soisson, William J. Storck. **News Editor:** Wilbert C. Lepkowski
Staff Editor: Ernest L. Carpenter
Senior Editors: New York: Earl V. Anderson; Chicago: Joseph Haggin; Washington: Lois R. Ember, Rebecca L. Rawls
Associate Editors: Stuart A. Borman, Mairin B. Brennan, Doron Dagani, Bette Hileman, Richard J. Seltzer, Pamela S. Zurer
Service Departments Editor: Dolores Miner
Editing Services: Anne Riesberg (Head), Patricia Oates (Administrative Assistant)
News Bureaus: New York: (212) 697-3223 Stephen C. Stinson (Associate Editor). Marc S. Reisch (Assistant Editor). Chicago: (312) 256-4143 Ward Worthy (Head). Houston: (713) 973-8161 Bruce F. Greek (Head). Washington: (202) 872-4495 David J. Hanson (Associate Editor). West Coast: (415) 653-3630 Rudy M. Baum (Head). **Foreign Bureau:** London: (01) 540-0414 Dermot A. O'Sullivan (Head), Patricia L. Layman (Associate Editor)
Graphics and Production: Leroy Corcoran (Manager). Alan Kahan (Art Director). Barbara Fryer (Production/Art Director). Linda Mattingly (Staff Artist). Diane Kelly (Costing). **Business Manager:** Arthur Poulos
Circulation Development: Cynthia G. Smith

ADVISORY BOARD: William J. Bailey, Jacqueline K. Barton, Ernest H. Drew, Harry G. Drickamer, A. Nicholas Filippello, Myron Foveaux, Vincent L. Gregory Jr., Adam Heller, John D. Holmfeld, Donald F. Hornig, Isabella Karle, Dorothy Nelkin, Richard Nicholson, Howard A. Schneiderman, Ellen K. Silbergeld, Howard E. Simmons, William P. Slichter, Richard N. Zare

Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-8733
John K Crum, Executive Director

PUBLISHING BOARD: Barbara G. Wood (*Chairman*); *Board of Directors Chairman:* Ernest L. Eliel; *President:* Mary L. Good; E. E. McSweeney; John H. Nelson; Louis D. Quin; and Jean'ne M. Shreeve

© Copyright 1987, American Chemical Society

Subscription Service: Send all new and renewal subscriptions with payments to: Director, Business Management Division, ACS, P.O. Box 57136, Washington, D.C. 20037. Correspondence and telephone calls for changes of address, claims for missing issues, subscription service, status of records and accounts should be directed to: Manager, Membership & Subscription Services, ACS, P.O. Box 3337, Columbus, Ohio 43210; (614) 421-3776.

For changes of address, include both old and new addresses with ZIP code numbers and mailing label from a recent issue. Allow four weeks for change to become effective. Claims for missing numbers will not be allowed if loss was due to failure of notice of change of address to be received in the time specified; if claim is dated (a) North America: more than 90 days beyond issue date, (b) all other foreign; more than one year beyond issue date; or if the reason given is "missing from files."

Subscription Rates 1987. Printed editions: nonmembers U.S. 1 yr. $44, 2 yr. $75, outside U.S. 1 yr. $70, 2 yr. $127. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $6.00. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

Advertising Management
CENTCOM LTD.
(For list of offices see page 71)

LETTERS

CAS billing changes

SIR: The changes that Chemical Abstracts Service plans to make in billing for use of its on-line databases (C&EN, Sept. 28, page 44) are wrong and should be reconsidered.

CAS would reward inefficient use of its databases by penalizing efficient users with its new fees. On the surface, what CAS proposes seems eminently reasonable, the new fees being assessed to approximate the value of the information obtained. Ultimately, however, the fees and the policy behind them would harm not only CAS's present users, but also U.S. chemical science and industry.

It is supremely ironic that an arm of a professional society avowedly seeking to advance chemistry would implement this antitechnology fee schedule. As a patent attorney who occasionally accesses the CAS databases, I presumably would benefit from the proposal, my unsophisticated search techniques and constant references to the database manual subsidized by the higher fees CAS will extract from professional searchers. Fortunately, I'll never need to learn new search techniques or buy more sophisticated software; CAS will protect me from both.

Alex R. Sluzas
Philadelphia

Chemical Abstracts Service's response: Alex Sluzas correctly identifies technology as the single most important consideration underlying our new pricing policy, but incorrectly concludes that the new fee schedule is antitechnology. CAS continually endeavors to introduce new technology that lightens the task of the searcher, and strongly encourages others to do likewise. If some such technology also has the effect of substantially reducing the amount of connect-time required to conduct a search, this does not speak against the technology itself, but against the use of connect-time as a viable basis for charging.

As a database producer, CAS's primary pricing objective is to receive sufficient revenues from on-line searching to help defray the costs of building the database. We agree with Sluzas' conclusion that the new pricing policy will benefit less sophisticated searchers, and we believe it will benefit professional searchers as well. The new policy is aimed at measuring use of the database in ways that are independent of the technology employed, thus providing more flexibility for the introduction of important new technology, while preserving the revenue base required to conduct the business of the society.

Harry Boyle
CAS, Columbus

Issues for ACS publications

SIR: Polemics are not my style, but Andrew Pudzianowski's 20-column-inches of prose (C&EN, Oct. 12, page 2), which purports to comment on my letter (C&EN, July 20, page 5), deserves one or two footnotes.

I did not state, suggest, or imply that scientists should not participate in debate on political, social, economic, or technological issues. I did suggest that when they do so, that they find a forum other than ACS publications. For example, I happen to feel strongly about certain activities of the American Civil Liberties Union but I do not expect C&EN to carry discussions of these issues even though they are of great concern to scientists.

With regard to the axiom that experts are not qualified to make decisions, the key word is decisions. Good managers are generalists who listen to experts then make their own decisions. Experts are by definition single-minded, limited in their view, and so forth. The litany of disastrous "solutions" by experts is long; e.g., the Aswan dam, or perhaps the green revolution. The point also is illustrated in a comment made by one of the names Pudzianowski drops. In a conversation, one of us pointed out that a certain well-known, able administrator was a chemist. He said, with a twinkle in his eye, "Yes, but he was a bad chemist."

The really offensive aspect of some scientists who enter the public arena is the open or thinly disguised elitism. The implication is that anyone with a technical degree is larger than life. Again, I'll illustrate from my experience. A physicist was visibly offended during debate of an environmental issue when I suggested that he was entitled to one vote, as we all were.

What becomes tiresome is the preoccupation with "cosmic" issues; e.g., nuclear war or nuclear energy. Everyone who knows that atoms are fissionable is an immediate expert on nuclear war. My experience includes rocket technology, so naturally I must be an expert in missile warfare! In contrast, where are the people rushing to solve the problems of ACS? For example, the issue of fraud in research is very real. By all accounts the academic types are running—running for cover, that is. They would like to see George solve this problem. Obviously it

Chemical Capital Spending To Jump 20% in 1988

Rising exports are keeping capacity use high, have helped spur major U.S. chemical companies to sharply boost plant and equipment spending

Marc S. Reisch, C&EN New York

Capital expenditures by U.S. industry will show a healthy increase in 1988 compared with 1987, according to preliminary forecasts by leading chemical producers. Eleven of 12 major chemical companies surveyed by C&EN estimate their 1988 expenditures will rise 20% to $6.84 billion compared with 1987. (Du Pont, the biggest chemical capital spender, had not responded with its 1988 estimate at press time.) The 1988 forecast follows a modest 6% increase in capital spending in 1987 compared with the previous year.

Chemical producers apparently feel that, despite a weak domestic economy, their sales to foreign customers are on the upswing. According to Charles B. Reeder, head of Charles Reeder Associates and former chief economist at Du Pont, the chemical industry, like the textile and paper industries, is "running flat out." The decline in the value of the U.S. dollar has led to increased exports as well as some substitution for imported goods by domestic production. Reeder believes this trend "will continue and warrant fairly vigorous capital spending in 1988."

In spite of the nosedive the stock market took in October, U.S. producers continue to forecast a good fourth quarter. And most of them report strong orders and predict continued sales and profit growth into 1988. But the stock market decline does presage continued weak consumer demand.

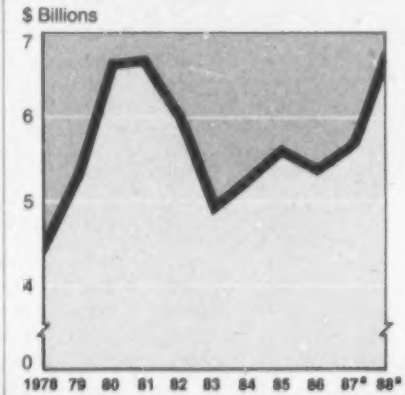
Two of the chemical industry's big markets—housing and automobiles—remain soft. The housing market has been hurt in particular by the new federal tax law, which has eliminated many incentives to build. Housing also is slumping in certain parts of the country where local economies are under siege. In Houston, for instance, the oil industry is still under pressure because of low energy prices. The recent stock market decline also has slowed office construction demand in New York City, center of the financial service industry, as banking and trading concerns trim their expansion budgets and personnel needs.

The auto industry also has been hurt by the new tax law and its phaseout of deductions for state sales taxes. To a degree, auto sales during the last part of 1986 sated demand for new automobiles in early 1987. Capacity utilization rates of auto makers have declined from about 80% late in 1986 to 62% in August 1987, according to statistics compiled by the Federal Reserve Board. More recent figures show only a modest recovery for auto production to 73% in October. Economists say that consumer demand is unlikely to pick up for automobiles anytime soon, particularly as consumers remain cautious following the recent drop in stock prices.

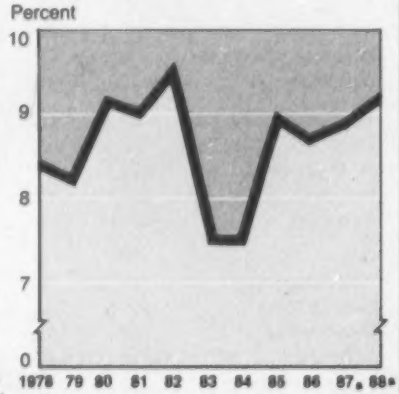
As for a third major market—agriculture—economists see slightly better prospects for the domestic farm economy next year. However, agricultural chemicals show strength only in specific product lines. High yields, poor demand, and foreign competition continue to dog farmers and the agricultural chemicals business.

Despite problems in the economy, commodity chemicals such as propylene, polyvinyl chloride, and acrylonitrile are in strong demand. PVC production, for instance, is at record levels. Available capacity seems to be about the only factor now holding back PVC production,

Chemical capital spending will rise sharply in 1988...



...and also will increase as a percentage of sales



Note: Combined data from 12 major chemical producers listed on page 10. a C&EN estimates.

forecast to grow 2 to 4% in 1988 (C&EN, Dec. 14, page 9). And while commodity prices spiral upward on steadily increasing demand, feedstock prices remain stable as oil prices promise to remain level or even decline.

All this bodes well for exports. In fact, export volume has grown steadily ever since the dollar began its steady decline, points out Reeder. The U.S. trade deficit has increased only as more depreciated dollars are needed to pay for the relatively lower volume of imports coming into the country now than at the same time last year, he says.

With stable and even declining oil prices expected in the months ahead, as well as the modest wage increases workers have received in recent years, chemical producers are betting that 1988 will be an excellent year for exports. This will keep capacity utilization high and will help fuel the dramatic increase in plant and equipment spending planned for 1988 by the major chemical producers surveyed by C&EN.

The 6% increase in capital spending in 1987 compared with 1986 was a lot better than the less than 1% increase predicted in last year's survey (C&EN, Dec. 22, 1986, page 9). Estimated 1987 capital spending for a number of companies was higher than the industry as a whole planned last year. W. R. Grace increased expenditures 38% to $275 million. The hike reflects the increased emphasis Grace is placing on the specialty chemical businesses since the company spun off its retailing and restaurant operations.

Du Pont boosted its capital spending 13% in 1987 to $1.8 billion compared with expenditures a year earlier. Increasing their spending about 12% were PPG Industries and Rohm & Haas. PPG's expenditures rose to $400 million and Rohm & Haas' to $200 million. Dow Chemical and American Cyanamid increased their spending at a more modest rate: Dow 9% to $970 million and Cyanamid 4.6% to $275 million.

Other chemical producers barely kept up with inflation or saw their capital expenditures decline in 1987. While Monsanto increased its 1987 spending a meager 1% to $525 million, Air Products drew back 0.3% to $366 million, and Olin decreased its capital expenditures 4.7% to $122 million from its 1986 spending level. Union Carbide reduced its spending 6.5% to $490 million. And Hercules dropped its investment in plant and equipment a huge 22% to $200 million.

Nine of the 12 chemical producers plan double-digit increases in their capital spending in 1988. The exceptions are Air Products, which is forecasting a 9.3% rise from this year in its expenditures to $400 million, and Monsanto, which plans to cut its spending 2.3% next year to $513 million. Rohm & Haas plans the biggest increase in 1988, 50% to $300 million. Other large increases are planned by Grace, up 46% to $400 million; Olin, up almost 30% to $158 million; and American Cyanamid, up 27% to $350 million.

Hercules plans a dramatic 25% increase in capital expenditures to $250 million following a large decline the year before. David S. Hollingsworth, chairman of the large chemical and aerospace concern, has stated that Hercules has completed the series of divestitures that culminated in its recent sale of a 37.5% interest in polypropylene producer Himont to Montedison. His assertion that "now it is time to grow" (C&EN, Oct. 12, page 9) may be fulfilled in Hercules' forecast 1988 capital expenditures increase.

Dow Chemical also plans a huge increase in capital expenditures with $1.2 billion earmarked for capital improvements, a 24% hike over this year's investment and the first time since 1981 that the company's total planned improvements will exceed $1 billion.

Others planning sizable boosts in their investment in plant and equipment include Union Carbide, with an 18% increase to $580 million compared with this year, and PPG, whose 13% increase to $450 million is pretty much in line with its increase in the level of spending this year.

These companies' capital spending in the U.S. will lag worldwide capital spending only marginally in

Chemical capital spending will soar next year

	1988		1987		Worldwide					Change from previous year	
$ Millions	Total	U.S.	Total	U.S.	1987 planned[a]	1986	1985	1984	1983	1988	1987
Air Products[b]	$ 400	$ 227	$ 366	$ 217	$ 400	$ 367	$ 392	$ 263	$ 246	9.3%	−0.3%
American Cyanamid	350	280	275	220	265	263	203	200	165	27.3	4.6
Dow Chemical	1200	660	970	590	980	890	806	781	630	23.7	9.0
Du Pont[c]	na	na	1800	1400	na	1587	1515	1319	1276	na	13.4
Ethyl	150	145	130	125	145	134	90	103	85	15.4	−3.0
W. R. Grace	400	na	275	185	300	199	348	380	353	45.5	38.2
Hercules	250	215	200	170	200	257	234	218	168	25.0	−22.2
Monsanto	513	338	525	338	520	520	645	614	560	−2.3	1.0
Olin	158	na	122	na	140	128	154	165	123	29.5	−4.7
PPG Industries	450	na	400	na	400	356	452	315	450	12.5	12.4
Rohm & Haas	300	230	200	170	200	179	159	124	72	50.0	11.7
Union Carbide	580	405	490	320	525	524	649	670	761	18.4	−6.5
TOTAL	$4751	$2500	$5753	$3735	$4075	$5404	$5647	$5152	$4889		
ANNUAL CHANGE[d]	20%	18%	6%	5%		−4%	10%	5%	−19%		

a Earliest estimates. b Fiscal year ends Sept. 30. c Excludes Conoco. d Cumulative change for companies reporting. na = not available.

West German chemical giants are bullish on U.S.

Though West Germany's three largest chemical companies forecast only a modest increase overall in their capital expenditure programs, they plan a rather hefty increase in their U.S.-based assets.

BASF, Bayer, and Hoechst combined plan a worldwide increase of 7% in 1988 capital spending to nearly $5 billion compared with this year. However, as a group they plan to increase expenditures in their U.S. operations 23% to $925 million.

This increase in capital spending is even larger than the 16% rise forecast by U.S.-based chemical producers. The West German giants, it would seem, are even more optimistic about prospects for their U.S. operations than their U.S.-based competitors are about their own domestic prospects.

The 23% increase, in part, reflects the fact that the dollar is cheaper than it was a year earlier. For comparison, capital spending figures for the three companies are based on a conversion rate of $1.00 = 1.6 deutsche mark for both 1987 and 1988. U.S. spending figures were supplied by the firms in U.S. dollars. Also for comparison, Hoechst's figures include Celanese's capital expenditures in 1986 when Celanese was not yet owned by Hoechst.

Bayer plans the largest increase in its 1988 spending with a forecast 13% rise to $1.7 billion worldwide. BASF is second with a 7.1% increase to $1.9 billion. Hoechst does not plan any increase in 1988.

	1988		1987		Change from previous year	
$ Millions[a]	Worldwide	U.S.	Worldwide	U.S.	1988	1987
BASF	$1875	$315	$1750	$260	7.1%	3.7%
Bayer	1687	260	1500	220	12.5	0
Hoechst	1437	350	1437	270	0	9.5
TOTAL	$4999	$925	$4687	$750		
ANNUAL CHANGE	7%	23%	4%	20%		

a $1.00 = 1.6 deutsche marks.

1988. The 11 companies responding to the C&EN survey estimate U.S. capital spending will rise an average of 16% compared with 20% worldwide. This follows capital expenditure increases of 6% worldwide and 5% in the U.S. in 1987.

Growth in capital spending has been fairly stagnant over the past few years, according to Myron T. Foveaux, trade and economic policy adviser for the Chemical Manufacturers Association. C&EN's surveys pretty much support this observation. Industrywide, Foveaux says, capital investment has grown only 4.5% annually over the past five years and, for the past three years, total chemical industry capital expenditures have hovered around $16.5 billion.

Foveaux says that his survey of chemical producers, conducted last month, indicates that they plan to increase capital expenditures an average 14% in 1988 over this year. Based on the survey, he forecasts that firms will spend about 10% of the total outside the U.S. during 1988. About 36% of investments will go to new facilities. And about 16% will be used to achieve compliance with environmental control regulations.

Chemical producers are unlikely to spend much on new petrochemical plants, Foveaux adds, in light of the large number of petrochemical plant shutdowns over the past five years. He believes that most new plant spending in 1988 will be for facilities to produce specialty products.

Foveaux cautions that, though chemical industry exports are expected to reach a record $26 billion this year, up 14% from 1986, imports also will be up markedly—5% over last year to a record $15.8 billion. The U.S. chemical industry probably will show a favorable trade balance of $10.3 billion for 1987, says Foveaux. Still, he adds, this is a far cry from the $12.2 billion trade balance the chemical industry recorded in 1980. □

Another item for your

LANTHOLOGY

of Ln's * *in modern chemistry*

Out of this California mine...

LANTHANIDES AND YTTRIUM, THE PRECURSORS OF TOMORROW'S SUPERCONDUCTORS

as aggressive research commercializes new-age...

MRI DIAGNOSTIC IMAGING
POWER GENERATION & STORAGE
COMPUTER & VLSI INTERCONNECTS
MAGNETIC SHIELDING & SQUIDS
COMPACT MOTORS & BATTERIES
NON-CONTACT BEARINGS
ULTRASENSITIVE I-R DETECTORS

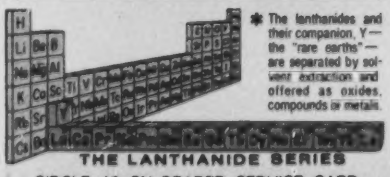
Over three decades this open-pit bastnasite mine, and the four processing plants it serves,* have supplied more than half of the world's need for the lanthanides (Y,La,Nd,Sm,Eu,Gd,Dy,Ho etc.)—the very elements essential to the new copper-oxide ceramic superconductors. And there's enough ore remaining for decades to come.

Write for specifications; phone for technology.

*Currently in a 4-step 5-year $10 to $20 million expansion.

UNOCAL 76
MOLYCORP

MOLYCORP, INC. • A Unocal Company
709 Westchester Ave., White Plains, NY 10604
Tel. 914/997-8880 • TWX 710/566-0305



* The lanthanides and their companion, Y—the "rare earths"—are separated by solvent extraction and offered as oxides, compounds or metals.

THE LANTHANIDE SERIES

CIRCLE 12 ON READER SERVICE CARD